BEFORE THE
SOUTH CAROLINA PUBLIC SERVICE COMMISSION

REBUTTAL TESTIMONY
OF
DR. MARK COOPER

ON BEHALF OF FRIENDS OF THE EARTH AND SIERRA CLUB
DOCKET NO.S 2017-207-E, 2017-305-E AND 2017-370-E

Q. Please state your name and address.

A. My name is Dr. Mark Cooper. I reside at 504 Highgate Terrace, Silver Spring, Maryland.

Q. Are you the same Mark Cooper who filed direct testimony in this proceeding?

A. Yes, and it is important to note that I also filed testimony on the Summer 2 & 3 nuclear reactor construction project in the summer and fall of 2012, released a report on the economics of Summer 2 & 3 in the summer of 2017 and an analysis that focused on Vogtle in 2018, with clear implications for the evaluation of the abandonment of Summer 2 & 3.

Q. Please summarize your testimony in this proceeding.

A. It is now clear that virtually all of the parties to these proceedings, except the utilities, agree that substantial portions of the costs of the abandoned Summer nuclear project were imprudently incurred and their recovery should be disallowed by the Public Service Commission. That imprudence conclusion is reached through either a determination that the project was imprudently managed and should have been abandoned at an earlier date, or that the utility misled the regulators - the Office of Regulatory Staff and this Commission - by

withholding material information known to the utility which reflected the mounting imprudence of continuing the project, or both. The ORS has concluded that such conduct by SCE&G in abusing its duty of disclosure to regulators amounted to "fraud" and imprudence as expressly defined by the amended Base Load Review Act (BLRA) . The ORS and intervening parties differ only on the date when such utility imprudence should trigger abandoned project cost disallowance. My clients, Friends of the Earth and Sierra Club, have contended from the very inception of this project in 2008 that it was an imprudent and reckless gamble and that facts known to the utility industry generally demonstrated that the project would fail to deliver its promised economies, compared to far less risky and cheaper alternatives. When I appeared before this Commission in 2012, I was charged with reviewing and opining on the prudence of the "going forward" decision at that time, assuming the prudence of costs already sunk in the project which had been approved by the Commission, based on the utility's glowing assurances. In this case, however, post project abandonment, I have been asked to review and offer my expert opinion on the prudence of all project costs back to the beginning, since the utility now seeks post abandonment recovery of all those project costs pursuant to the provisions of the BLRA. I have concluded, as explained in my testimony, that all of those nuclear project costs were imprudently incurred, given the facts known at the time to the utility and the duty of care and disclosure to the regulators expected of a reasonable utility.

In 2012, using reality-based, forward data on nuclear costs, alternative costs and electricity market needs, I concluded that the continued construction of Summer 2 & 3 was uneconomic and should be abandoned. Above all, the publicly available evidence on the problems in the construction of the reactors replicated the historical pattern of nuclear

construction cost overruns to suggest strongly that costs would escalate far beyond the overruns that the company put before the Commission.

Recent information made available since the abandonment, at a moment when the projected cost had increased by about 50%, make it clear that the utility did not inform the PSC of the severe problems construction of the reactors had encountered. This was in direct violation of the utility's obligations under the Base Load Review Act and an established duty of disclosure and reporting to utility regulators. Had the PSC been informed of the truly dire conditions known to the utility at that time, it might well have agreed with me that the project was no longer economic.

As the evidence of problems mounted, the utility repeatedly failed to inform the PSC. Past decisions to allow cost overruns were made under false pretenses, actions that hid material information from the PSC. The withholding of the information is itself an imprudent behavior that reinforces the overall pattern of imprudence. Given the utility's disregard for the obligation to behave in a prudent manner and its misunderstanding of the BLRA, it is all the more clear that the imprudence reaches back to the very beginning of the project.

In that 2012 testimony I pointed to independent, third-party analyses and widely available accounts, as well as my own analysis of the cost of power from new nuclear reactors, to show that new nuclear power was uneconomic. The publicly available data from that period about the severe problems of the construction and cost of Summer units 2 & 3 have now been corroborated by internal and private documents and communication in the possession of the utility, neither of which were shared with the Public Service Commission. Thus, my position and that of my clients were not and are not a case of "20-20 hindsight." They are an example of reasonable and

prudent foresight that the utility should have exercised and the PSC could have enforced, if it had been told the whole truth.

The claim that the PSC approved the costs along the way and, therefore, the costs cannot now be disallowed is bogus and should be rejected by the Commission. The evidence now before the Commission shows that the company knew the problems with the project were far more serious than it had let on in public and in its disclosures to regulators or in PSC proceedings. Later, as problems mounted and Santee Cooper pushed for a management assessment, SCE&G finally agreed to such a review. The utility investigated and complained to the vendor, but never told the Commission. In many instances it sought to water down or suppress negative findings of its own investigation. None of this was reported to the PSC. If the utility had presented a realistic picture of the project, the PSC might well have agreed with me at the time. Failing to fully inform the Commission of the dire straits in which the utility found the project, is an imprudent act that prevented the Commission from doing its job.

The claim that the Commission should have been able to overcome or decipher the obfuscation in which the utility engaged is equally bogus. The utility was in the best position to evaluate the project and had the obligation to inform the Commission of the real state of affairs. The fact that the utility felt compelled to whitewash its own analyses and withhold them from the PSC is a good indication that full disclosure might have led the PSC to disallow costs or order the abandonment of the project altogether.

Q. Does your timeline of the nuclear economic disaster jibe with the other intervenors in this proceeding.

A. All of the non-utility intervenors in this proceeding have generally concluded that the management of SCE&G engaged in significantly imprudent decisions and behaviors that require a substantial disallowance of costs. They arrive at that conclusion through somewhat different routes, but the underlying facts in all cases are the same. A review of the timeline of events illuminates the remarkable unanimity on the finding of imprudence and it also provides a useful framework for evaluating my recommendation that all costs incurred since project inception be disallowed. It was only my testimony on behalf of my clients, Friend of the Earth and the Sierra Club, that argued for abandonment of the project in late 2012, based on a forward-looking analysis of the then-current situation. With full knowledge, a larger review is in order.

Many of the intervenors point to the delivery to SCE&G of an audit it commissioned by Bechtel. An equally important milestone is the date of the internal debate over the commissioning of that report, since the utility clearly had to be deeply concerned about the project to initiate the audit in the first place. Neither of these two milestone actions were reported to the Commission. Moreover, there appears to have been some "scrubbing" of the report, even though it was to be kept internal.

By the time the audit was commissioned, however, there had to be enough signs of trouble to bring the utility to ask for it. The dates of the events that triggered the concerns stretch back four years to the first days of the project construction and even the fact that project design had not been completed and approved. Indeed, the utility had sent an aggressive (one might even say angry and threatening) letter to the vendor in 2014, before the Bechtel audit was commissioned. As I had earlier noted in my direct testimony in 2012, the history of missed delivery dates was also laid out in gory detail in the utility CEO letter to the vendor. This letter was never shared with the PSC. With the abandonment of the project and the release of some of

these documents that had been withheld from the PSC, we see other third-party observations that reinforce the fact that there were the dire problems that afflicted the project from the earliest days.

Overlaying the timeline of my involvement with the so called "nuclear renaissance" and the Summer project, as well as my client's involvement, takes the argument for imprudence all the way back to the very beginning of the project in 2008, as I noted in my direct testimony in this proceeding. However, I want to focus now on the events from mid-2012 and later.

In my initial 2012 testimony I concluded that continuing construction of Summer 2 & 3 was uneconomic. The utility responded belatedly with an analysis of its own by Dr. Lynch, claiming that nuclear construction was still preferable to reliance on gas. In arriving at this conclusion, they engaged in what can only be described as "myopic, tooth fairy" economics. It is "tooth fairy" economics because it could only conclude that nuclear reactor construction made economic sense by making enough unrealistic and unsupported assumptions so they could show that in some parallel universe nuclear could, just barely, be economic. They made the same mistakes in underestimating nuclear costs and overestimating gas costs, as they had made in the original economic analysis. It is "myopic" because the utility continued to ignore the issues of excess capacity and the availability of much lower cost, low carbon alternative sources of generation, no matter how dramatically the cost of the alternatives declined and those alternatives were embraced by the rest of the utility industry. In 2012, I showed that even taking sunk costs into account, nuclear was far from the least cost option.

Q. How does Santee Cooper's actions with regard to the project fit the overwhelming evidence of the uneconomic nature of the project?

A. It has recently come to light that Santee Cooper, the owner of 45% of the Summer 2 & 3 capacity, had commissioned a study of the economics of the project, which reached exactly the same conclusion as I did at roughly the same time. The fact that Santee Cooper, a publicly owned utility, determined that it needed to exit the project early, may reflect its unique situation, but the fact that it could not find a utility (public or private) to buy out its share of the project (or the power from it), speaks volumes about the dire condition of new nuclear construction. For example, as I pointed out in my direct testimony in 2012, the CEO of the nation's largest nuclear utility was very publicly stating that new nuclear reactor construction made no economic sense.

Santee Cooper's dissatisfaction with the project and the troubling bind in which it found itself are instructive for the analysis of imprudence and the denial of cost recovery. Santee Cooper had to get out of the project because they do not have the luxury of separating stockholders from ratepayers. The strategy of sticking it to ratepayers, but not stockholders, is not available to them. The fact that other investor-owned utilities would not buy the project, even though they could place the impact on ratepayers, suggests that the project was simply uneconomic from the point of view of both public-power and investor-owned utilities.

The point of a prudence review gets directly at this issue, since its primary purpose is to protect ratepayers from abuse in a situation where the utility is inclined to pursue projects or incur costs that are in the interest of stockholders, but not ratepayers. It is exactly this function that was undermined by the withholding and candy coating of data about the project.

As bad as things were at the end of 2012, they went downhill from there and all of the negative factors that Santee Cooper feared were evident: nuclear costs escalated, while the cost of alternatives continued to decline, the recession ended and economic growth returned, but demand for electricity remained stagnant and the need for the project evaporated. My analysis of

the deteriorating economics of Summer was published in the summer of 2017, with a similar analysis of its sister project, Vogtle, in 2018.[1]

Thus, at least by the end of 2012 it was time to exit from the project (as Santee Cooper was trying to do). Whether the PSC would have told the utility that it was imprudent to continue wasting ratepayer money before that point, if they had been given a complete and unvarnished description of the dire straits of the project, I cannot say,. But that was a right moment to quit and the failure of the utility to fully inform the PSC demands that the PSC disallow costs after that point, independent of the question of pushing disallowance back to the beginning.

Q. How does the ORS analysis compare to your timeline?

A. The Office of Regulatory Staff has had a lot of time to analyze a trove of documents that were suppressed and marked as confidential. ORS has devoted a great deal of attention to the later part of the period and the Bechtel audit. My focus in briefly summarizing the ORS analysis, as shown in Attachment MNC Rebuttal-1, is on the Bechtel audit looking backward.

The severe and early problems with the project, in the 2011-2012 period, are clear in the documents, both those from SCE&G, complaining to Westinghouse and, in particular, from Santee Cooper, in looking at the deteriorating economics of the project. The fact that the complaints point backward reinforces my view. The severity of the problems was not conveyed to the PSC over this period and the implications of the failure to deliver modules, captured with descriptions like "no real confidence, broken promises, placing the project schedule in jeopardy once again," was not conveyed to the PSC.

[1] Mark Cooper, *The Failure of the Nuclear Gamble in South Carolina: Regulators can Save consumers Billions by Pulling the Plug on Summer 2 & 3 Already Years behind Schedule and Billions Over Budget Things are Likely to Get Much Worse If the Project Continues,* July, 2017; *A Clean Slate for Vogtle, Clean Energy for Georgia The Case for Ending Construction at the Vogtle Nuclear Power Plant and Reorienting Policy to Least-Cost, Clean Alternatives,* March 2018.

Two developments flowing from these basic difficulties are highlighted in Exhibit MNC Rebuttal-1. Santee Cooper, which had already engaged an expert to evaluate the economics of the project from their financial point of view, began pushing for an expert to review the management of the project. This led to the line of disputes over the work of Bechtel, which was retained to conduct that review, and ended with the vigorous efforts of the utility to "redact" criticism of SCE&G and withhold the document.

The second line is a series of events linking financial exposure stemming from the underlying problems with the project. Santee Cooper concluded early on that the project was uneconomic. SCE&G offered its theory on imprudence to financial analysts soon after the decision to hire an expert to look into project management. This suggests to me that they understood the audit would raise issues about the prudence of their behavior. Although they insisted their theory protected them, they were well aware that the poor performance in managing the project would raise questions.

This is another layer added to the data that indicates the utility failed to act prudently in not abandoning the project. The first layer was provided in my 2012 testimony, where I offered a mountain of publicly available evidence that nuclear reactor construction was uneconomic; as well as mounting evidence of significant early problems that the construction of the AP1000 was having. The second layer was the mix of public information made available and some private documents that the utility was forced to divulge as a result of the battle over abandonment and the recovery of abandoned cost. The third layer, summarized in MNC Rebuttal-1, but backed up with the extensive ORS Exhibits, involves the internal documents attesting to the problem that the utility sought to suppress.

These timelines and background discussions provide a firm foundation on which to rebut and reject the company's arguments against my abandonment proposal.

Q. How do you respond to the testimony of Glenn Hubbard?

A. The three "mistakes" Hubbard accuses me of are fictions of his imagination that result from a lack of familiarity with the history of this project or my prior testimony.

First, my 2012 testimony, to which he makes no reference was not "20-20 hindsight,"[2] but reasonably prudent foresight, based on the then-current facts on the ground, including sunk costs and severe delay problems the project was suffering.

Q. What is the second "mistake" you did not make?

A. I certainly did consider sunk costs[3] imposed on the alternatives in my rebuttal to the company's eleventh-hour economic analysis. Six years later, in describing the role of sunk costs in the utility effort to game the regulatory process, my 2018 testimony isolated the sunk costs after the failure of the utility to inform the PSC of the severe problem the project had suffered. It is part of the recognition of the "to-go" scam that nuclear utilities use to extract every high payments and impose dramatic burdens on ratepayers, a scam I had described, over three decades earlier, in illuminating the first nuclear fiasco of the "great bandwagon" market for nuclear reactors.[4]

[2] Hubbard, p. 4.
[3] Hubbard, p.6.
[4] "On Behalf of Mississippi Legal Services Coalition in the Matter of the Citation to Show Cause Why the Mississippi Power and Light Company and Middle South Energy Should not Adhere to the Representation Relied Upon by the Mississippi Public Service Commission in Determining the Need and Economic Justification for Additional Generating Capacity in the Form of A Rehearing on Certification of the Grand Gulf Nuclear Project," Before the Mississippi Public Service Commission, Docket No. U-4387, August 13, 1984

Similarly, I did not base my analysis on the ridiculously high gas price forecast of 2008, even though it was completely out of touch with reality. What I showed was that by the time the utility began making major construction expenditures, the price of gas had collapsed and there was little likelihood of it spiking. This analysis did not involve hindsight, but reasonably prudent foresight, which was the basis of my recommendation for abandonment. I will elaborate on this point in responding to Mr. Lynch.

Q. What is the third "mistake" you did not make?

A. Third, the claim of dire consequence if the PSC disallows any costs is also a fiction,[5] for three reasons.

First, Hubbard takes a remarkably narrow, pro-utility view of costs. He cautions that any disallowance will raise the cost of capital. However, the cost of capital is only part of the burden that the construction of an uneconomic facility imposes on ratepayers. Ratepayers are also forced to pay for an excessive amount of capital, which has two components in this case: excess capacity and huge cost overruns. Hubbard fails to note that this project doubled the rate base of the company even before it suffered the cost overruns and it produced reserve margins that were twice the required level. Abandonment of the project could lower the amount of excess capital in the rate base by much more than the increase in the cost of capital. Ratepayers could be better off with disallowances.

Second, Hubbard assumes that ratepayers can be forced to swallow sunk costs at triple or quadruple the cost of new generation being achieved elsewhere without any consequences. That assumption is dubious. Ratepayers forced to absorb such excessive costs will resist. The first

[5] Hubbard, p. 8. These points respond to the broad theme of dire consequences from any disallowances put forward by several of the other SCE&G witnesses, including Griffin, Hevert, and Lapson.

line of resistance will be from large users like Walmart. Given the widespread availability of decentralized alternatives, these customers will seek to self-supply significant parts of their demand. Residential ratepayers will push for the same option. Demand will decline and the utility will enter into a death spiral, as it tries to make up for lost revenue with rate increases added atop the sunk costs. This threat of the "death spiral" stems from the existence and availability of lower cost alternatives that the utility refused to consider in its economic analysis. Notwithstanding the utility's myopic view, the alternatives exist in the real world. Ratepayers might be better off with disallowances.

Third, abandonment and disallowance might actually be easier for the market to deal with and have a smaller impact on the cost of capital than Hubbard surmises, for other reasons (i.e. in addition to the fact that the burden on ratepayers is alleviated). First, the construction of a single facility at such high cost, with so much excess capacity, representing a capital outlay equal to the entire value of the company was a singularly imprudent thing to do. This was a one-shot mistake that the utility is not likely to make again for decades. That is, there were three decades between the mistakes made in the nuclear fiasco of the 1970s-80s and the mistakes made in the failed "nuclear renaissance." Given that 90% of the reactor projects discussed during the "nuclear renaissance" never got into the construction phase, investors can be fairly confident that the utility will not make a similar mistake soon. Current investors have paid the price, but future investors do not have to punish the stock for a mistake that is not likely to be repeated.

Q. Do you find other flaws in Hubbard's analysis?

A. Yes. The biggest omission in Hubbard's testimony is the failure to acknowledge the withholding of information from the PSC. Whether this withholding of material information

rises to the level of a violation of securities law, or fraud which he seems to ignore, is a matter in the hands of investigators, but it is clear to all of the interveners, except the utility, that the withholding of material information implicates the prudence of utility action. Even if the Base Load Review Act did involve an element of 'before-the actual-expenditure' (*ex ante)* prudence review, which I do not believe it did, the withholding of material information compels the PSC to revisit decisions that were made under false pretenses – the pretense, fostered by the company, that the project was not in dire straits**.**

Taken to its illogical conclusion, Hubbard's theory of 'before-the-actual-expenditure' (*ex ante)* prudence review means that no matter how poorly the utility performed or badly it behaved, it gets to keep every penny, even if, as may be the case here, it broke the law. I contend that this is not what they BLRA allows, especially in the case of abandonment.

Not surprisingly, Hubbard has set this up as a "win-win" for the utilities. He argues that "This process, if administered properly, can be expected to result in investments that the Company and its regulators found to be prudent on an *ex ante* basis."[6] Hubbard never seems to consider that in order for the process to be "administered properly" the utility has to behave too and live up to its part of the bargain, which it failed to do in this case on two counts: abysmal management and failure to disclose the problems to the PSC.

Hubbard also makes a series of mistakes in his analysis of the data I used, but these simply repeat the mistakes of Dr. Lynch, so I will deal with them in the next section.

Q. How do you respond to the testimony of Dr. Lynch?

Dr. Lynch's criticism of my testimony is totally dependent on the claim that 'before-the-actual expenditure' (*ex ante)* prudence review is a blank check in which no matter how poorly

[6] Hubbard, p. 10.

the utility performed, it can cash that check. In his view, the BLRA included a presumption of ironclad *ex ante* prudence and every decision made by the PSC is inviolable. I disagree as a general matter. Moreover, the failure of the utility to fully inform the Commission of the dire situation of the project, stretching back to the beginning of the construction phase, compels the PSC to revisit those decisions.

In my 2012 testimony I argued that the BLRA required constant vigilance. This should have been clear to the utility and the PSC affirmed it in one of its earliest orders dealing with Summer 2 & 3 construction.[7]

> While the BLRA represented a dramatic change in the way rates are set for new nuclear reactors built in South Carolina, it did not abandon the fundamental concepts of just, reasonable and prudent that govern the setting of utility rates. Advanced cost recovery under the BLRA gives nuclear costs very special treatment, but it is not a blank check and it does not diminish the obligation of the utility to ensure that it delivers the least cost electricity to ratepayers.
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> This cost overrun proceeding signals to the commission that the utility has failed to continue to practice the cost vigilance it is obligated to exercise… With this request, the cost overruns have now driven the total cost of the project above the original cost estimate plus the contingency cost pool. The BLRA requires a prudence review of the increase in costs and this is the moment for a thorough review of the cost and economic viability of the project. (2012, Direct pp. 3-4)

The combination of the erroneously narrow view of imprudence under the BLRA, the failure to fully inform the Commission of the severe problems in executing the project, and the ultimate abandonment, undercuts the claim that the PSC blessed whatever the utility did and entitled the utility to full recovery. Dr. Lynch complains that my direct testimony is just a rehash of 2012, but revisiting all the decisions since then is exactly what is in order. The utility's actions denied the PSC the opportunity to exercise its proper vigilance.

[7] ORS witness M. Anthony James provides a detailed review of the company obligations going back to the BLRA and initial PSC order implementing it soon after its enactments, while others provide analysis of the effort to the legislature to clarify the intent of the Act.

What the PSC must conclude in light of subsequent revelations is that, had they been told the whole truth in 2012, or 2015, or 2016; or for that matter at the very beginning of the project, they would have stopped cost recovery and placed the utility at risk for all future costs, or rejected the project as imprudent in the first place. With informed regulatory oversight SCE&G would have abandoned the project, as Santee Cooper was trying to do with its early search for potential buyers of its share of ownership.

Q. Please discuss Dr. Lynch's rehash of the utility's erroneous arguments.

A. Dr. Lynch rehashed the erroneous arguments the utility made along the way, claiming that the utility's forward-looking analysis justified the project. I showed that the utility never took a realistic, forward-looking view of the project. My conclusion that the utility was wrong on a forward-looking basis in 2012 is correct, underpinned by a realistic view of the delivery/cost problems the project had already encountered. Recalling the initial analysis only serves to remind us how far from reality it was and how much information was available to dissuade virtually every other utility from pursuing new reactor construction, even in states with advanced cost recovery.

Because the utility's witnesses have so completely misrepresented my 2012 testimony and ignored the utility culpability, I will rehash a few issues, trying to keep it simple and addressing points that Lynch makes about subsequent utility testimony. By emphasizing the forward looking nature of my analysis, and the utility's errors, I deal with the "hindsight" issue, discussed above in response to Hubbard.

Q. Would a realistic estimate of the nuclear reactor costs have led to the recognition that the project was uneconomic?

A. Yes, and it appears that, at the time, everyone knew this, except the utility and the vendor, who were already arguing about who was responsible. There was little, if any chance the reactors would ever be economic. The consultant hired by Santee Cooper, Howard Axelrod, concluded as much in his economic analysis. The failure of any utilities to offer to take over Santee Cooper's share of the project attests to the common knowledge of the uneconomic nature of the project.

John Rowe, the chairman of Exelon, the largest nuclear utility in the nation, had loudly declared in March of 2012 that the so-called "nuclear renaissance" was dead on arrival:

> Nuclear power is no longer an economically viable source of new energy in the United States, the freshly-retired CEO of Exelon, and America's largest producer of nuclear power, said in Chicago Thursday.
> And it won't become economically viable, he said, for the foreseeable future.[8]

Exelon's analysis had been showing this for several years and he made his point by showing the cost of carbon abatement, which undercuts Lynch's claim that nuclear power was necessary to meet the need to reduce carbon emissions.

In my 2012 surrebuttal response to the utility's "eleventh hour effort to justify continuation of the project,[9]" I included examples of Exelon's forward-looking analysis from 2010 and 2011, attached here as Exhibit MNC REBUTTAL-2. If the PSC had been given a true

[8] Jeff, McMahon, **"**Exelon's 'Nuclear Guy': No New Nukes," Mar 29, 2012, Forbes.

[9] Surrebuttal Testimony of Mark Cooper, p. 1, The hastily prepared analysis demonstrates exactly the opposite. The numerous flaws, omissions and biases in this sur-sur-rebuttal testimony makes it even more evident that the South Carolina Public Service Commission (SCPSC) should reject the claim for cost over runs in this docket and require the utility to conduct a proper, complete and balanced review of all the available alternatives so that the SCPSC can evaluate the prudence of continuing the construction of the nuclear reactors and avoid saddling ratepayers with billions of dollars of excessive rates for electricity. The analysis is fundamentally flawed in numerous conceptual and methodological ways, as was the analysis done four years ago. These flaws have been magnified by the marketplace, technology, and policy developments of the past four years. The analytic framework is wrong at the level of economic theory, policy reality, and management practice. The empirical analysis is incomplete, opaque and biased in its assumptions and methodologies.

picture of the state of the project at the time, it would have been better able to see the true location of nuclear power on the supply curve of low carbon resources. As I said at the time:

> Inexplicably and in direct contrast to its own risk analysis, the company treats nuclear costs as though they were a certainty and fails to consider future cost overruns or increases in escalation. This could add billions to the nuclear scenario revenue requirement. A twenty percent increase in the construction cost could tip more than half the scenarios considered by SCE&G in favor of natural gas.[10]

Here it is important to stress that the first pillar on which my recommendation for abandonment rests was the cost overruns, which interacted with other failures of the utility to recognize reality.

Q. Was the utility unduly pessimistic about the future cost of gas?

A. In my direct testimony in 2012, I showed that it was, but even this unjustified pessimism would not have supported continuation, if realistic costs had been used for the nuclear project. Dr. Lynch pats the utility on the back for using as a "gas price +50%," which puts the utility just north of the EIA price in 2030. As the upper graph in Exhibit MNC Rebuttal-3 shows, the actual price of gas, as measured by Henry Hub wellhead past and future (out to 2025, for which trades are reported on the Chicago Mercantile Exchange), the real-world price has consistently been at a level of about EIA – 40%.

In my testimony in 2012, I showed that the realistic price had a huge impact on the relative position of gas verses nuclear in carbon abatement cost, summarized in the lower graph of Exhibit MNC Rebuttal-3. At the then current prices, the number of scenarios in which nuclear might be less costly is cut in half, and this does not take construction cost escalation into account. I also argued that this conclusion was reinforced by the relative direction of the capital cost of resource acquisition.

[10] Cooper, Surrebuttal, p. 6

> The capital cost of adding natural gas capacity has probably declined relative to nuclear. While the underlying cost escalators for all utility plant construction has declined, the cost overruns for nuclear have taken back all of the reduction in the escalation that could have lowered consumer bills. Since capital costs account for a much smaller share of the total cost for gas plant, the effect is small, but not insignificant. (2012, Direct, p.15)

A 20% cost overrun would obliterate any chance that nuclear would be lower in cost, even under more extreme assumptions about gas prices and carbon taxes. Such cost increases were a virtual historical certainty, as corroborated by the 50% cost overrun at the time of abandonment, with much more to come.

Q. Did you offer a forward looking analysis of cost overruns in 2012?

A. I did. I pointed out that the utility had already taken two bites at cost overruns, but that history and experience showed this was just the beginning. I included a graph showing that history, attached to this testimony as the upper graph in Exhibit MNC Rebuttal-4.

> I show in my testimony that there are numerous ways in which the costs the utility now seeks to recover from ratepayers should have been anticipated in the original cost estimate, but were not or have been caused by actions of the utility or its vendors. Ratepayer should not be held responsible for the burden of these actions. In addition, there is an even more fundamental reason that these costs should not be 1recovered from ratepayers – the overall project is no longer prudent. (2012, Direct, 4)

The actual cost of AP1000s in the Southeast has ended up pretty close to the actual line I calculated in that graph.

> Exhibit MNC -10 presents a comprehensive view of U.S. nuclear construction cost estimates and actual costs, which I began compiling in 2009 to evaluate the question of whether nuclear cost escalations are predictable. Versions of this graph have been reprinted in a number of diverse places, with the version in Exhibit MNC-10 drawn from my article in the current issue of the *Bulletin of the Atomic Scientists*. Not only was the tendency for cost escalation known from the first generation of nuclear reactor construction, the recent cost estimates had shown a similar tendency from the beginning of the so called "nuclear renaissance" to 2008 when the utility put forward its cost estimate here. By comparing cost escalation in France and the U.S., and analyzing the fundamental problem that safety poses for nuclear power, I have shown that the cost escalation problem is endemic to the technology. (2012, Direct 24-25)

We now know from internal documents that the projections offered at the time were unrealistic. The lower graph of MNC Rebuttal-4 shows the reasonable projection and actual escalation of nuclear costs in comparison to the actual change in cost of the alternatives. In my 2012 testimony I argued that the changing circumstances afforded the PSC the opportunity to revisit important issues. The key was the difficulty of execution of nuclear construction, again clear in the suppressed documents in the current docket.

Q. Did the same refusal to look at reality afflict the utility demand-growth projections?

A. It did and Lynch staunchly defends those projections. Exhibit MNC Rebuttal-5 shows that Lynch's demand forecast is simply indefensible when confronted with reality. Although I accepted the utility focus on natural gas for the purposes of showing that nuclear was uneconomic in my direct testimony in 2012, I argued that the reality created another opportunity to reconsider alternatives as an option. This point was noted by the Santee Cooper consultant.[11]

> A dramatic reduction in demand growth reinforces this conclusion because natural gas plants can be added in smaller increments and shorter time periods, resulting in a better fit between need and capacity…. That reduction in demand equals substantially more than half of the capacity the nuclear project will bring on line for SCE&G. This will result in a sharp increase in capacity above the reserve margin requirement, which increases the cost to ratepayers. Adding smaller increments farther out in the future reduces both the level of capital spending and the present value of the revenue requirement.[12]
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> Showing that the conclusion reached by the utility and accepted by the commission is no longer valid presents the most direct challenge to the prudence of decision making on a going forward basis. I also note in my testimony that the change in circumstances creates the possibility to revisit alternatives like efficiency and renewables. (2012, Direct, p.14)

[11] Howard Axelrod, Energy Strategies Inc. to: Sylleste Davis, Santee Cooper, Summary Report on Energy Strategy's VCS Marketing Activities, March 11, 2013, p. 5.

[12] As cited by Direct Testimony of Scott J. Rubin on Behalf of AARP, Before the Public Service Commission of South Carolina, on the Joint Application and Petition of South Carolina Electric & Gas Company and Dominion Energy, Inc. for review and approval of a proposed business combination between SCANA Corporation and Dominion Energy, Inc., as may be required, and for a prudency determination regarding the abandonment of the V.C. Summer Units 2 & 3 Project and associated merger benefits and cost recovery plans, Docket No. 2017-370-E, September 18, 2018, p. 18.

> The luxury of time afforded by the slowing of demand growth creates the opportunity for the utility to develop and expand the efficiency option to see how far it can go. Efficiency as a low cost resource has not been well developed by the utility…
>
> The cost of other alternatives, like wind, solar photovoltaics, geothermal and hydro that can make a contribution to future needs has been falling and with time are projected to be cost competitive with central station facilities. Time is a critical factor here, too. The ability to gather more information and observe trends is a valuable option to improve decision making in an environment typified by a great deal or risk and uncertainty. Slowing demand growth enhances the opportunity to exercise this real option. Combined with the much shorter lead time needed to construct gas plants, the portfolio made up of gas and efficiency and renewables is much lower in cost and more flexible. (2012, direct, p. 19)

Q. How does your analysis compare to the analysis from AARP?

A. The AARP witness reaches a very similar conclusion as I did.[13]

> There is no question that in March 2013, and the months leading up to that point, numerous utilities had rejected the NND Project because it was not economically viable or not consistent with their provision of low-cost service to customers. While Dr. Axelrod tweaked various assumptions to try to show that nuclear power could be cost competitive with natural gas, Santee Cooper did not find any utilities that agreed. Faced with this information in March 2013 (when the NND Project was less than 50% complete), coupled with the significant construction delays and deficiencies that still had not been remedied, it is my opinion that a prudent utility would have declined to spend more money on the Project.
>
> Indeed, as Dr. Axelrod stated, power prices during peak demand periods were expected to be $50 per MWh or less through 2020, while the NND Project (assuming no more cost over-runs or significant delays) would cost on the order of $100 per MWh. Several other utilities in the region rejected the NND Project because it was not a prudent investment for them. SCE&G should have acted prudently and done the same in March 2013.[14]

Several points in this observation should be emphasized.

First, the failure to find a potential buyer reflects the sad state of the "nuclear renaissance." The dozens of utilities that had expressed initial interest in the federal loan guarantees, had been winnowed down to less than a dozen and a half who filed license applications and only two (Summer and Vogtle) that had gone into construction.

[13] Direct Testimony of Rubin on Behalf of AARP,
[14] Direct Testimony of Rubin on Behalf of AARP, p. 17.

Second, it is interesting to consider how the Santee Cooper consultant Axelrod "tweaked various assumptions to try to show that nuclear power could be competitive." The outcome could only exist in the alternative universe of the utility tooth fairy.[15] Such erroneous "tweaked" assumptions include:

Construction costs had to stabilize, not increase by at least 50%;

Natural gas prices had to rise to the cost plus 50% scenario, not fall to EIA minus 40%;

Carbon emissions addressed (taxed) by federal policy, which never happened;

Economic recovery accelerated demand, which did not happen.

The most important point, as I have emphasized throughout, is the cost escalation. Under the base-case assumptions, gas was less costly in 88% of the cases. With a 50% increase in costs, it never wins, even if the other assumptions are more favorable to nuclear.

Q. Does this conclude your testimony?

A. Yes, I have refuted the nine obstacles thrown out by Hubbard and Lynch in an effort to prevent the PSC from examining the question of prudence with a full body of evidence. That evidence compels the denial of cost recovery back to the end of 2012, as demonstrated in my earlier testimony; and back to the inception of the project as now demonstrated after abandonment, as based on the law, sound regulatory principles and the empirical evidence.

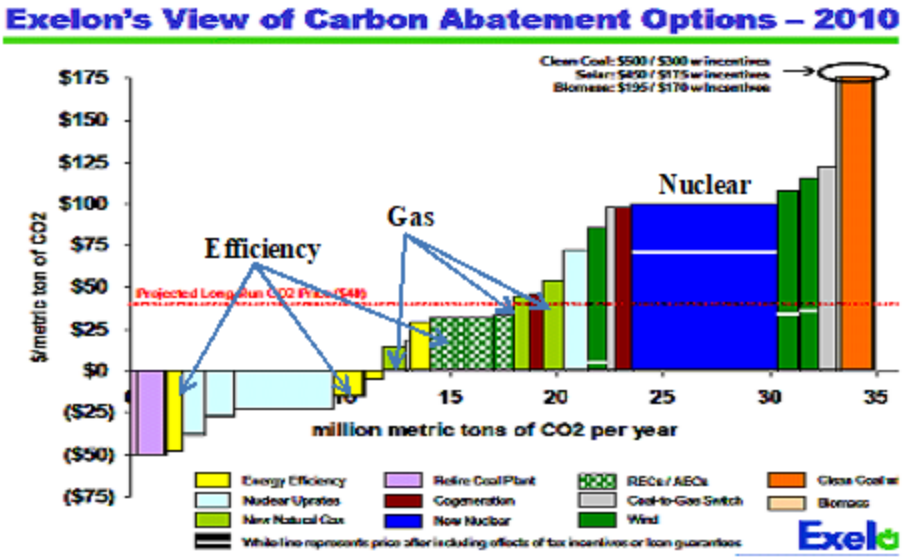
[15] Axlerod, 2013, p. 8.

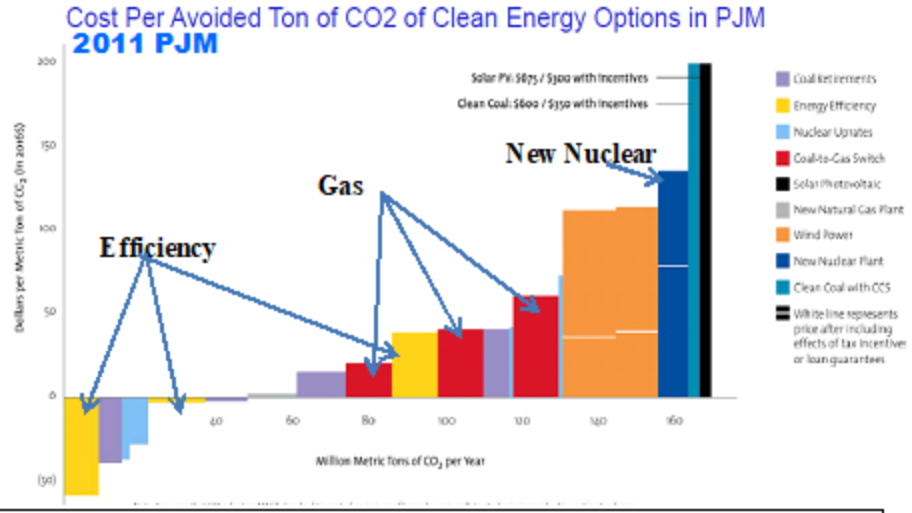
Date	Documenting Severe Problems back to 2011	
3/11/13	SC - 2011 re-evaluating generation need, consultant concludes project uneconomic	
3/11/13	SC - Consultant concludes project uneconomic	
8/23/13	SC– For almost two years Santee Cooper and SCE&G have been working… to correct submodule deliver issues….Although early indications were positive… the delivery record unfortunately demonstrates otherwise, placing the project schedule in jeopardy once again.	
10/21/13	SC – "we have received so many new schedules that are meaningless. We have no real confidence in their ability to provide modules as scheduled.	
2/20/14	SC & SCE&G – Almost completely new management at CB&! And a lot of new folks with WEC. Withholding payment until milestones are hit.	
4/24/14	ORS reported that 88% of remaining milestones have been delayed. Schedule re-baseline would require full hearing	
5/6/14	– Letter…blasting Consortium for poor performance on modules, recurring schedule delays form 2011 until present, and design delays… "you have made promise after promise, but fulfilled few of them."	
	Wrangling Over an Expert to Study Management Flaws	**Financial Exposure**
5/0/14	SC - Hire an expert	
9/3/14	SCE&/G - Ready to hire	
10/30/14		SCE&G Assurances on Imprudence: BLRA ratepayers on the hook for cost overruns. SCANA does not believe any imprudence on their part.
12/10/14		lacking estimate to complete… SCE&G heading to litigation
1/28/15	Bechtel proposes scope	
2/17/15	SC - Hire Bechtel	
2/19/15		SCE&G Assurances on Imprudence: It would have to be imprudent before they deny it and imprudency on the part of us, the utility, which I think would be difficult for anybody to prove"
4/7/15	SCE&G open to moving Bechtel Forward	
9/0/15	Bechtel approved	
10/22/15	Bechtel presentation	
11/12/15	SCE&G suggests removing criticism	SCE&G suggests removing criticism
12/7/15	Bechtel, "What Gives", redactions defeat purpose of the report	Bechtel, "What Gives", redactions defeat purpose of the report
3/316		SC - Huge cost of delay
2/11/16	SC prepares counter interpretation of Bechtel	
3/316		SC - Huge cost of delay
3/29/16	SC - Review Bechtel v. SCE&G action	
6/16/2016 , 6/68/16	SC (citing Bechtel)- SCE&G was never fully supportive…" You cannot help someone who does not want your help," SCE&G needs more help	
11/28/16	SC - Frustration with lack of increased project management	

EXELON'S FROWARD LOOKING ANALYSIS OF ALTERNATIVES LOW CARBON RESOURCES

EXHIBIT MNC-R-2- 1:

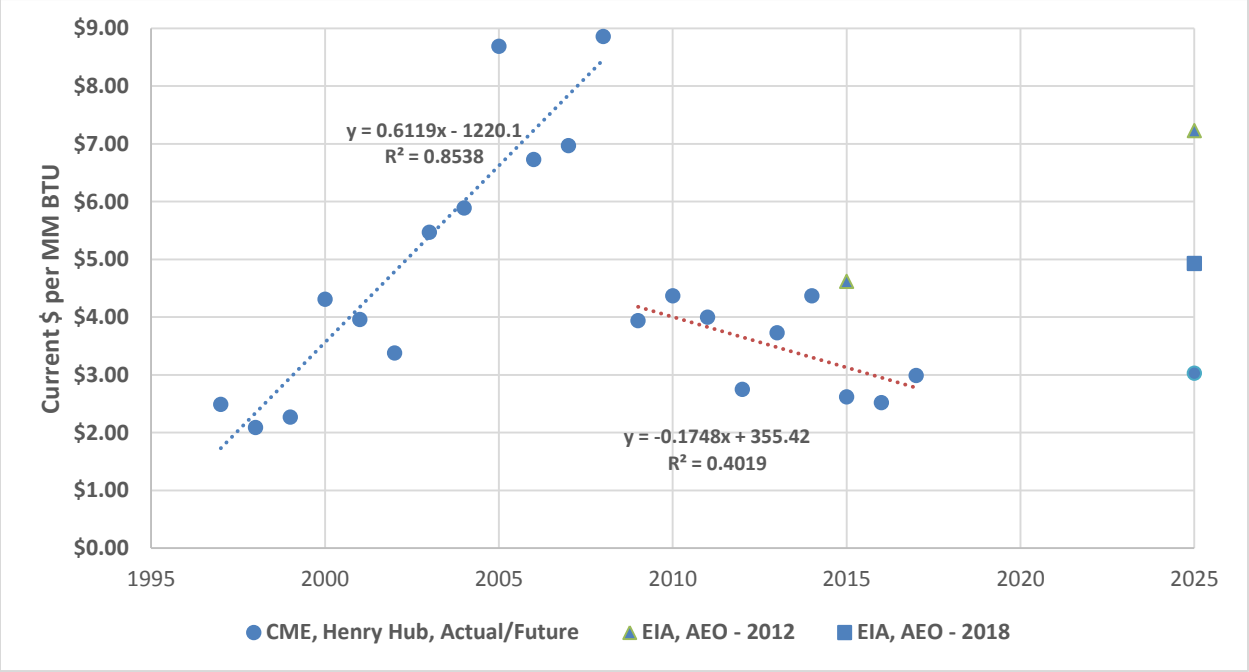
EVALUATING OPTIONS IN TERMS OF THE COST OF CARBON REDUCTIONS





Sources: Rowe, John, *Fixing the Carbon Problem without Breaking the Economy,* Resources for the Future Policy Leadership Forum Lunch, May 12, 2010; *Energy Policy: Above All, Do No Harm,* American Enterprise Institute, March 8, 2011

HENRY HUB V. EIA PROJECTED NATURAL GAS PRICES



Sources: Energy Information Administration, Natural Gas Prices, Chicago Mercantile Exchange, Natural Gas Futures.

MNC-5

CURRENT GAS PRICES DRAMATICALLY ALTER THE DISTRIBUTION OF OUTCOMES

Change in Levelized Rev. Req.: Gas Strategy Minus Nuclear Strategy
Positive Entries Represent Nuclear Advantage in Millions of Dollars

CO_2 Price / Escalation	$0	$5	$10	$15	$20	$25	$30	$35	$40	$45	$50
0%	-87	-75	-63	-51	-40	-28	-16	-5	7	19	31
2%	-87	-71	-55	-39	-23	-7	9	25	41	57	73
4%	-87	-64	-42	-20	2	24	47	69	91	113	135
5%	-87	-60	-34	-7	19	45	72	98	124	151	177
6%	-87	-55	-24	8	39	71	102	134	165	197	228
8%	-87	-41	5	50	96	141	187	233	278	324	369
10%	-87	-19	48	116	183	250	318	385	453	520	587

Source: Exhibit H (Lynch, 2008, Exhibit JML-2), p. 11.

MNC-10

Overnight Construction Cost per KW, in $2010

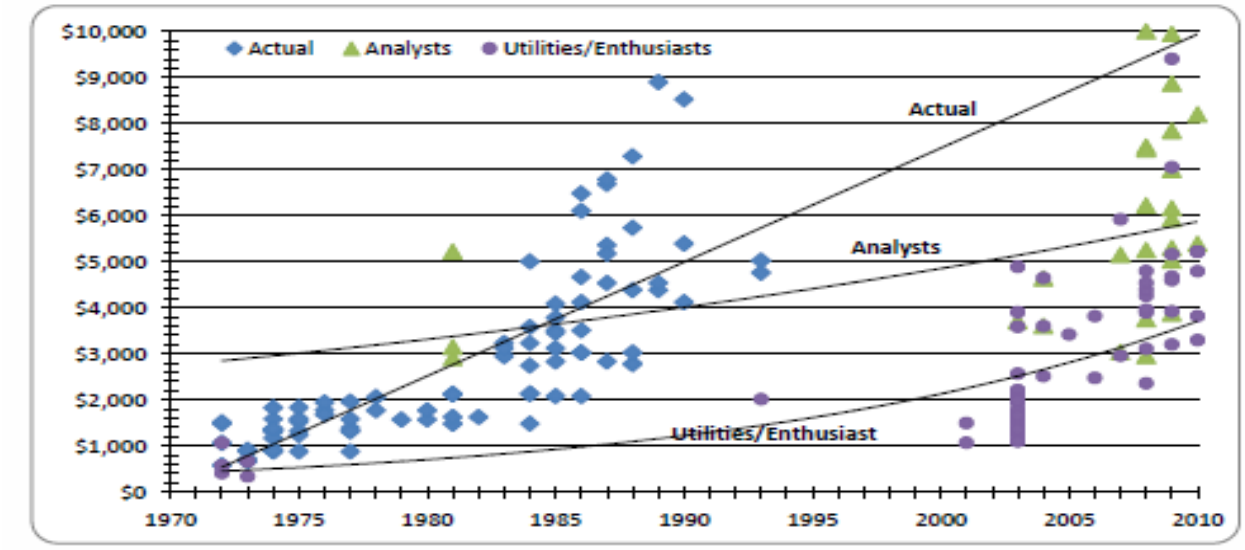
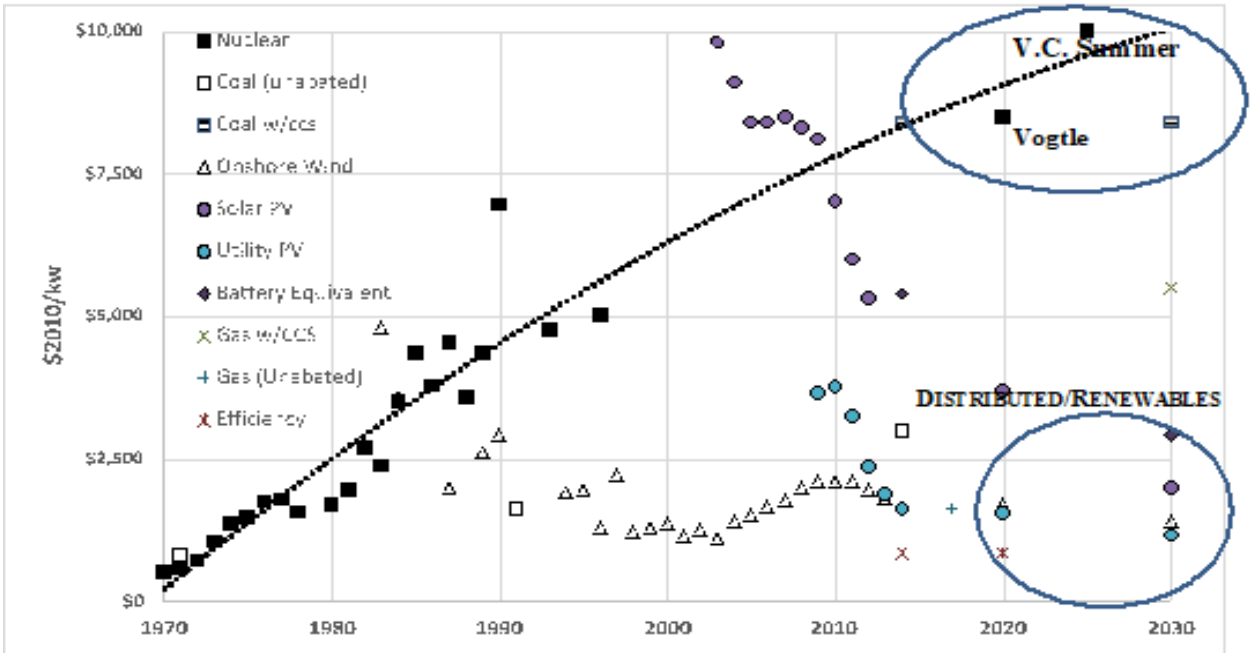


FIGURE I-1: PAST, PRESENT AND FUTURE COST OF NUCLEAR POWER V. ALTERNATIVES

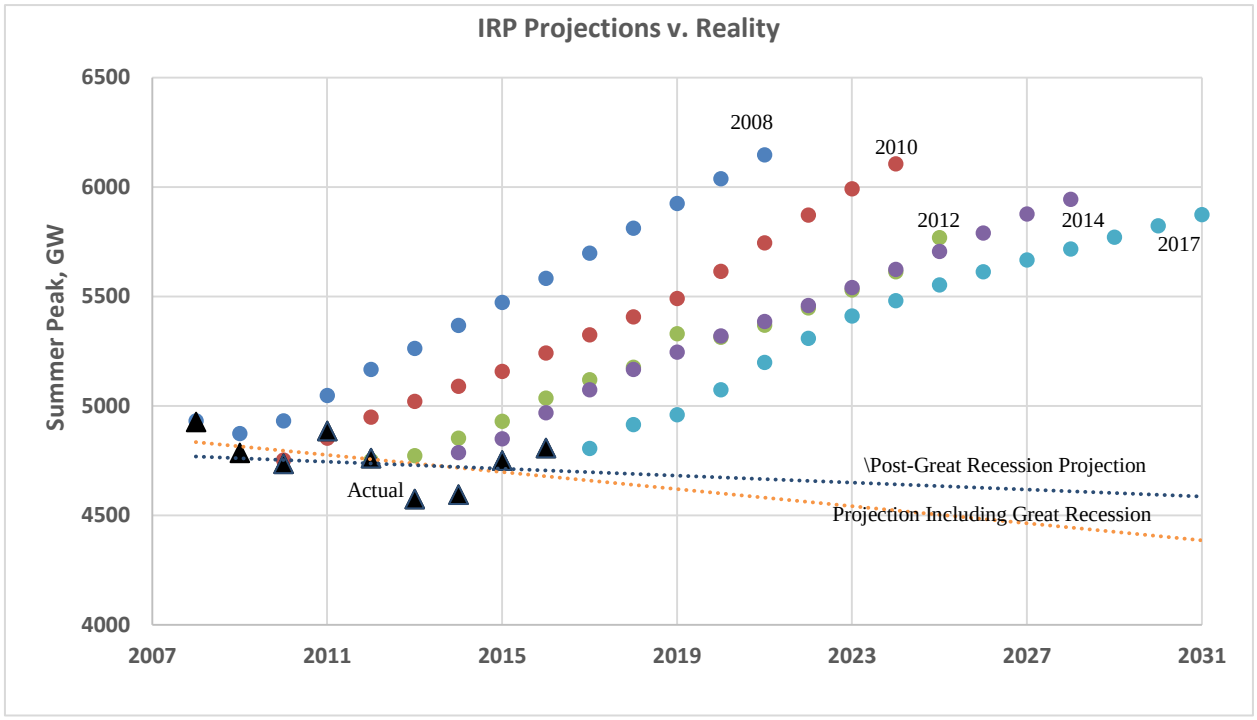
CENTRAL STATION

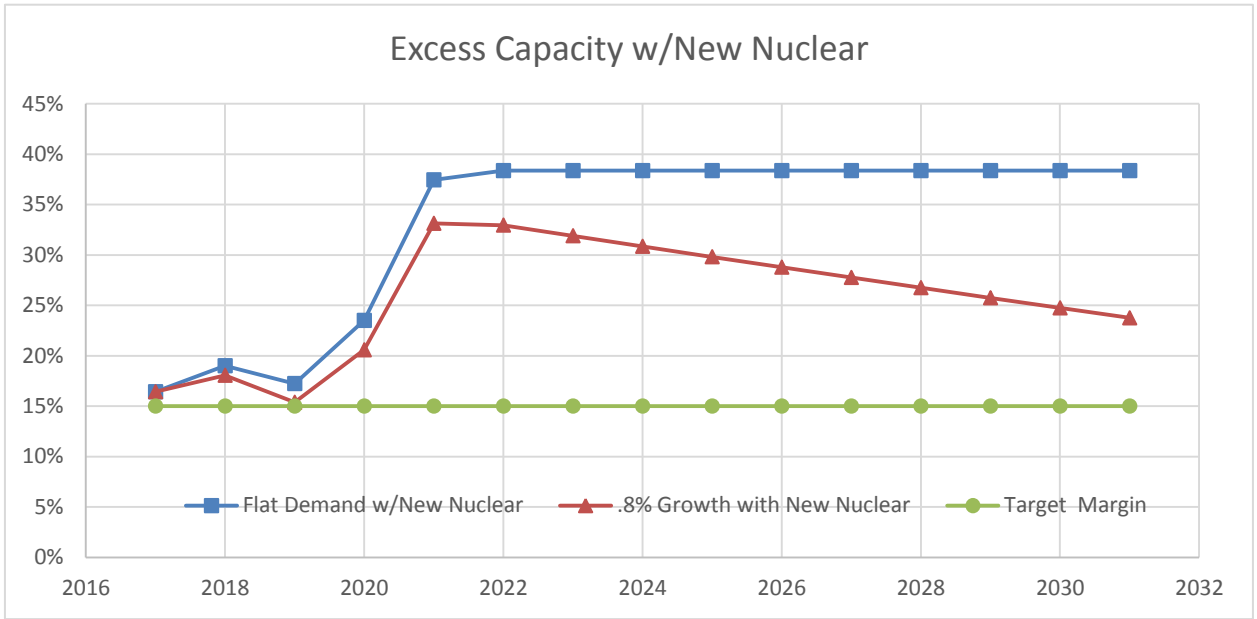


Source: Updated and adapted from Mark Cooper, *The Political Economy of Electricity: Progressive Capitalism and the Struggle to Build a Sustainable Sector* (Santa Barbara, Praeger, 2017), Figure 2.1 and accompanying text.

MNC REBUTTAL-5

DEMAND GROWTH: IRP PROJECTIONS V. REALITY





Source: Projections, SCE&G Integrated Resource Plans, various years, page 2. Actual, 2017, p.33